

What is claimed is:

1. A catalyst for polyester production,  
comprising a solid titanium compound (I-a) which is  
obtained by dehydro-drying a hydrolyzate obtained by  
5 hydrolyzing a titanium halide and has a molar ratio  
(OH/Ti) of a hydroxyl group (OH) to titanium (Ti)  
exceeding 0.09 and less than 4.
2. A catalyst for polyester production,  
10 comprising a titanium-containing solid compound (I-b)  
which is obtained by dehydro-drying a hydrolyzate  
obtained by hydrolyzing a mixture of a titanium halide  
and a compound of at least one element selected from  
elements other than titanium or a precursor of the  
15 compound and has a molar ratio (OH/Ti) of a hydroxyl  
group (OH) to titanium (Ti) exceeding 0.09 and less  
than 4.
3. The catalyst for polyester production as  
20 claimed in claim 2, wherein the compound of at least  
one element selected from elements other than titanium  
or the precursor of the compound is a compound of at  
least one element selected from the group consisting  
of beryllium, magnesium, calcium, strontium, barium,

scandium, yttrium, lanthanum, zirconium, hafnium,  
vanadium, niobium, tantalum, chromium, molybdenum,  
tungsten, manganese, iron, ruthenium, cobalt, rhodium,  
nickel, palladium, copper, zinc, boron, aluminum,  
5 gallium, silicon, germanium, tin, antimony and  
phosphorus or a precursor of the compound.

4. A catalyst for polyester production,  
comprising:

10 a polycondensation catalyst component comprising  
the solid titanium compound (I-a) of claim 1 and/or  
the titanium-containing solid compound (I-b) of claim  
2, and

(II) a co-catalyst component comprising a compound  
15 of at least one element selected from the group  
consisting of beryllium, magnesium, calcium, strontium,  
barium, boron, aluminum, gallium, manganese, cobalt,  
zinc, germanium, antimony and phosphorus.

20 5. A catalyst for polyester production,  
comprising:

a polycondensation catalyst component comprising a  
solid titanium compound (I-c) obtained by dehydro-

drying a hydrolyzate obtained by hydrolyzing a titanium halide, and

- (II) a co-catalyst component comprising a compound of at least one element selected from the group
- 5 consisting of beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc, germanium, antimony and phosphorus.

6. The catalyst for polyester production as
- 10 claimed in claim 5, wherein the co-catalyst component (II) is a magnesium compound.

7. A catalyst for polyester production, comprising a titanium-containing solid compound (I-d)
- 15 obtained by dehydro-drying a hydrolyzate obtained by hydrolyzing a mixture of a titanium halide and a compound of at least one element selected from elements other than titanium or a precursor of the compound.

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8. The catalyst for polyester production as claimed in claim 7, wherein the compound of at least one element selected from elements other than titanium or the precursor of the compound is a compound of at

least one element selected from the group consisting of beryllium, magnesium, calcium, strontium, barium, scandium, yttrium, lanthanum, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum,

- 5 tungsten, manganese, iron, ruthenium, cobalt, rhodium, nickel, palladium, copper, zinc, boron, aluminum, gallium, silicon, germanium, tin, antimony and phosphorus or a precursor of the compound.

- 10 9. A catalyst for polyester production, comprising:

a polycondensation catalyst component comprising the titanium-containing solid compound (I-d) of claim 7 or 8, and

- 15 (II) a co-catalyst component comprising a compound of at least one element selected from the group consisting of beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc, germanium, antimony and phosphorus.

20

10. The catalyst for polyester production as claimed in claim 9, wherein the co-catalyst component (II) is a magnesium compound.

11. A catalyst for polyester production,  
comprising a solid titanium compound (I-e) obtained by  
a process comprising bringing a titanium halide into  
contact with water to hydrolyze the titanium halide  
5 and thereby obtain an acid solution containing a  
hydrolyzate of the titanium halide, rendering the  
solution basic by the use of a base, then adjusting pH  
of the solution to 2 to 6 by the use of an acid, and  
dehydro-drying the resulting precipitate.

10

12. A catalyst for polyester production,  
comprising a solid titanium compound (I-f) obtained by  
a process comprising bringing a titanium halide into  
contact with water to hydrolyze the titanium halide  
15 and thereby obtain an acid solution containing a  
hydrolyzate of the titanium halide, adjusting pH of  
the solution to 2 to 6 by the use of a base, and  
dehydro-drying the resulting precipitate.

20

13. A catalyst for polyester production,  
comprising:

(I) a polycondensation catalyst component  
comprising the solid titanium compound of claim 11 or  
12, and

(II) a co-catalyst component comprising a compound of at least one element selected from the group consisting of beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc, germanium, antimony and phosphorus.

14. The catalyst for polyester production as claimed in claim 13, wherein the co-catalyst component (II) is a magnesium compound.

10

15. A catalyst for polyester production, comprising a titanium-containing solid compound (I-g) obtained by a process comprising bringing a mixture of a titanium halide and a compound of at least one element selected from elements other than titanium or a precursor of the compound into contact with water to hydrolyze the titanium halide and thereby obtain an acid solution containing a hydrolyzate of the titanium halide, rendering the solution basic by the use of a base, then adjusting pH of the solution to 2 to 6 by the use of an acid, and dehydro-drying the resulting precipitate.

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16. The catalyst for polyester production as claimed in claim 15, wherein the compound of at least one element selected from elements other than titanium or the precursor of the compound is a compound of at least one element selected from the group consisting of beryllium, magnesium, calcium, strontium, barium, scandium, yttrium, lanthanum, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, manganese, iron, ruthenium, cobalt, rhodium, nickel, palladium, copper, zinc, boron, aluminum, gallium, silicon, germanium, tin, antimony and phosphorus, or a precursor of the compound.

17. A catalyst for polyester production, comprising a titanium-containing solid compound (I-h) obtained by a process comprising bringing a mixture of a titanium halide and a compound of at least one element selected from elements other than titanium or a precursor of the compound into contact with water to hydrolyze the titanium halide and thereby obtain an acid solution containing a hydrolyzate of the titanium halide, adjusting pH of the solution to 2 to 6 by the use of a base, and dehydro-drying the resulting precipitate.

18. The catalyst for polyester production as claimed in claim 17, wherein the compound of at least one element selected from elements other than titanium  
5 or the precursor of the compound is a compound of at least one element selected from the group consisting of beryllium, magnesium, calcium, strontium, barium, scandium, yttrium, lanthanum, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum,  
10 tungsten, manganese, iron, ruthenium, cobalt, rhodium, nickel, palladium, copper, zinc, boron, aluminum, gallium, silicon, germanium, tin, antimony and phosphorus or a precursor of the compound.

15 19. A catalyst for polyester production, comprising:

(I) a polycondensation catalyst component comprising the titanium-containing solid compound (I-g) or (I-h) of any one of claims 15 to 18, and  
20 (II) a co-catalyst component comprising a compound of at least one element selected from the group consisting of beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc, germanium, antimony and phosphorus.



20. The catalyst for polyester production as claimed in claim 19, wherein the co-catalyst component (II) is a magnesium compound.

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21. A catalyst for polyester production, comprising a solid titanium compound (I-i) which is obtained by dehydro-drying titanium hydroxide and has a crystallinity, as calculated from an X-ray  
10 diffraction pattern having  $2\theta$  (diffraction angle) of  $18^\circ$  to  $35^\circ$ , of not more than 50 %.

22. A catalyst for polyester production, comprising:

15 (I) a polycondensation catalyst component comprising the solid titanium compound (I-i) of claim 21, and

(II) a co-catalyst component comprising a compound of at least one element selected from the group  
20 consisting of beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc, germanium, antimony and phosphorus.

23. A catalyst for polyester production,  
comprising a slurry obtained by heating a mixture of:

(A-1) a hydrolyzate (I-j) obtained by hydrolyzing  
a titanium compound or a hydrolyzate (I-k) obtained by  
5 hydrolyzing a mixture of a titanium compound and a  
compound of at least one element selected from  
elements other than titanium or a precursor of the  
compound,

(B) a basic compound, and  
10 (C) an aliphatic diol.

24. The catalyst for polyester production as  
claimed in claim 23, wherein the basic compound (B) is  
at least one compound selected from tetraethylammonium  
15 hydroxide, tetramethylammonium hydroxide, aqueous  
ammonia, sodium hydroxide, potassium hydroxide, N-  
ethylmorpholine and N-methylmorpholine.

25. The catalyst for polyester production as  
20 claimed in claim 23 or 24, wherein the aliphatic diol  
(C) is ethylene glycol.

26. A catalyst for polyester production,  
comprising:

(A-2) a hydrolyzate (I-m) obtained by hydrolyzing a titanium halide or a hydrolyzate (I-n) obtained by hydrolyzing a mixture of a titanium halide and a compound of at least one element selected from elements other than titanium or a precursor of the compound, and

(D) a metallic phosphate containing at least one element selected from beryllium, magnesium, calcium, strontium, boron, aluminum, gallium, manganese, cobalt and zinc.

27. The catalyst for polyester production as claimed in claim 26, wherein the metallic phosphate (D) is magnesium hydrogenphosphate or trimagnesium diphosphate.

28. A catalyst for polyester production, comprising a slurry obtained by heating a mixture of:

(A-2) a hydrolyzate (I-m) obtained by hydrolyzing a titanium halide or a hydrolyzate (I-n) obtained by hydrolyzing a mixture of a titanium halide and a compound of at least one element selected from elements other than titanium or a precursor of the compound,

(E) a metallic compound containing at least one element selected from beryllium, magnesium, calcium, strontium, boron, aluminum, gallium, manganese, cobalt and zinc,

5 (F) at least one phosphorus compound selected from phosphoric acid and phosphoric esters, and

(G) an aliphatic diol.

29. The catalyst for polyester production as  
10 claimed in claim 28, wherein the metallic compound (E) is a magnesium compound, the phosphorus compound (F) is phosphoric acid or trimethyl phosphate, and the aliphatic diol (G) is ethylene glycol.

15 30. The catalyst for polyester production as claimed in claim 28 or 29, wherein the heating temperature of the mixture of the components (A-2), (E), (F) and (G) is in the range of 100 to 200°C, and the heating time is in the range of 3 minutes to 5  
20 hours.

31. A process for producing a polyester, comprising polycondensing an aromatic dicarboxylic acid or an ester-forming derivative thereof and an

aliphatic diol or an ester-forming derivative thereof in the presence of the catalyst as claimed in any one of claims 1 to 30.

5           32. A process for producing a polyester, comprising an esterification step in which an aromatic dicarboxylic acid or an ester-forming derivative thereof and an aliphatic diol or an ester-forming derivative thereof are esterified to form a low  
10 condensate and a polycondensation step in which the low condensate is polycondensed in the presence of a polycondensation catalyst to increase the molecular weight, wherein:

the polycondensation catalyst used is a catalyst  
15 comprising:

(I) a polycondensation catalyst component comprising a hydrolyzate (I-j) obtained by hydrolyzing a titanium compound or a hydrolyzate (I-k) obtained by hydrolyzing a mixture of a titanium compound and a  
20 compound of at least one element selected from elements other than titanium or a precursor of the compound, and

(II) a co-catalyst component comprising a compound of at least one element selected from the group

consisting of beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc, germanium, antimony and phosphorus;

and

5        the polycondensation catalyst component (I) is added to the esterification reactor before the beginning of the esterification reaction or immediately after the beginning of the esterification reaction.

10

33. The process for producing a polyester as claimed in claim 32, wherein the co-catalyst component (II) is a magnesium compound.

15

34. A process for producing a polyester, comprising polycondensing an aromatic dicarboxylic acid or an ester-forming derivative thereof and an aliphatic diol or an ester-forming derivative thereof in the presence of a polycondensation catalyst

20        selected from the following catalysts (1) to (3) and a phosphoric ester to produce a polyester;

(1) a polycondensation catalyst comprising a hydrolyzate (I-m) obtained by hydrolyzing a titanium halide,

(2) a polycondensation catalyst comprising a hydrolyzate (I-n) obtained by hydrolyzing a mixture of a titanium halide and a compound of at least one element selected from elements other than titanium or  
5 a precursor of the compound, and

(3) a polycondensation catalyst comprising:  
the hydrolyzate (I-m) or (I-n), and  
a compound of at least one element selected from the group consisting of beryllium, magnesium,  
10 calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc, germanium and antimony, a phosphate or a phosphite.

35. The process for producing a polyester as  
15 claimed in claim 34, wherein the phosphoric ester is tributyl phosphate, trioctyl phosphate or triphenyl phosphate.

36. A process for producing a polyester,  
20 comprising polycondensing an aromatic dicarboxylic acid or an ester-forming derivative thereof and an aliphatic diol or an ester-forming derivative thereof in the presence of a polycondensation catalyst selected from the following catalysts (1) to (3) and

at least one compound selected from cyclic lactone compounds and hindered phenol compounds to produce a polyester;

(1) a polycondensation catalyst comprising a  
5 hydrolyzate (I-m) obtained by hydrolyzing a titanium halide,

(2) a polycondensation catalyst comprising a hydrolyzate (I-n) obtained by hydrolyzing a mixture of a titanium halide and a compound of at least one  
10 element selected from elements other than titanium or a precursor of the compound, and

(3) a polycondensation catalyst comprising:  
the hydrolyzate (I-m) or (I-n), and  
a compound of at least one element selected  
15 from the group consisting of beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc, germanium and antimony, a phosphate or a phosphite.

20 37. The process for producing a polyester as claimed in claim 36, wherein at least one phosphorus compound selected from phosphoric acid and phosphoric esters is further used in combination.



38. The process for producing a polyester as claimed in claim 36 or 37, wherein the at least one compound selected from cyclic lactone compounds and hindered phenol compounds is a mixture of 5,7-di-t-butyl-3-(3,4-dimethylphenyl)-3H-benzofuran-2-one, tetrakis(methylene-3(3,5-di-t-butyl-4-hydroxyphenyl)propionate)methane and tris(2,4-di-t-butylphenyl)phosphite.

39. A process for producing a polyester, comprising an esterification step in which an aromatic dicarboxylic acid or an ester-forming derivative thereof and an aliphatic diol or an ester-forming derivative thereof are esterified to form a low condensate and a polycondensation step in which the low condensate is polycondensed in the presence of a polycondensation catalyst to increase the molecular weight, wherein:

the polycondensation catalyst used is a catalyst comprising:

(I) a polycondensation catalyst component comprising a hydrolyzate (I-m) obtained by hydrolyzing a titanium halide or a hydrolyzate (I-n) obtained by hydrolyzing a mixture of a titanium halide and a

compound of at least one element selected from elements other than titanium or a precursor of the compound, and

(II) a co-catalyst component comprising a compound  
5 of at least one element selected from the group consisting of beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc, germanium, antimony and phosphorus;

and

10 a tint adjusting agent is added in the esterification step or the polycondensation step.

40. The process for producing a polyester as claimed in claim 39, wherein the tint adjusting agent  
15 is at least one agent selected from Solvent Blue 104, Pigment Red 263, Solvent Red 135, Pigment Blue 29, Pigment Blue 15:1, Pigment Blue 15:3, Pigment Red 187 and Pigment Violet 19.

20 41. The process for producing a polyester as claimed in claim 39 or 40, wherein the co-catalyst component (II) is a magnesium compound.

42. A method for treating a polyester, comprising bringing a polyester, which is obtained by the use of a titanium compound catalyst and in which the reaction has been completed, into contact with a phosphorous  
5 acid aqueous solution, a hypophosphorous acid aqueous solution, a phosphoric ester aqueous solution, a phosphorous ester aqueous solution or a hypophosphorous ester aqueous solution, each of said solutions having a concentration of not less than 10  
10 ppm in terms of phosphorus atom.

43. The method for treating a polyester as claimed in claim 42, wherein the polyester has an intrinsic viscosity of not less than 0.50 dl/g, a  
15 density of not less than 1.37 g/cm<sup>3</sup> and an acetaldehyde content of not more than 5 ppm.

44. The method for treating a polyester as claimed in claim 42 or 43, wherein polyethylene  
20 terephthalate, which is obtained by the use of a titanium compound catalyst and in which the reaction has been completed, is treated.

45. A method for treating a polyester, comprising bringing a polyester, which is obtained by the use of a titanium compound catalyst and in which the reaction has been completed, into contact with an organic  
5 solvent.

46. The method for treating a polyester as claimed in claim 45, wherein the polyester has an intrinsic viscosity of not less than 0.50 dl/g, a  
10 density of not less than 1.37 g/cm<sup>3</sup> and an acetaldehyde content of not more than 5 ppm.

47. The method for treating a polyester as claimed in claim 45 or 46, wherein the organic solvent  
15 is a solvent selected from alcohols, saturated hydrocarbons and ketones.

48. The method for treating a polyester as claimed in any one of claims 45 to 47, wherein the  
20 organic solvent is isopropanol or acetone.

49. The method for treating a polyester as claimed in any one of claims 45 to 48, wherein polyethylene terephthalate, which is obtained by the

use of a titanium compound catalyst and in which the reaction has been completed, is treated.

50. A method for treating a polyester, comprising  
5 bringing a polyester, which is obtained by the use of  
a titanium compound catalyst and in which the reaction  
has been completed, into contact with an organic  
solvent solution of phosphoric acid, an organic  
solvent solution of a phosphoric ester, an organic  
10 solvent solution of phosphorous acid, an organic  
solvent solution of hypophosphorous acid, an organic  
solvent solution of a phosphorous ester or an organic  
solvent solution of a hypophosphorous ester, each of  
said solutions having a concentration of not less than  
15 10 ppm in terms of phosphorus atom.

51. The method for treating a polyester as  
claimed in claim 50, wherein the polyester has an  
intrinsic viscosity of not less than 0.50 dl/g, a  
20 density of not less than 1.37 g/cm<sup>3</sup> and an acetaldehyde  
content of not more than 5 ppm.

52. The method for treating a polyester as  
claimed in claim 50 or 51, wherein the phosphoric

ester is tributyl phosphate, triphenyl phosphate or trimethyl phosphate.

53. The method for treating a polyester as  
5 claimed in any one of claims 50 to 52, wherein the organic solvent is a solvent selected from alcohols, saturated hydrocarbons and ketones.

54. The method for treating a polyester as  
10 claimed in any one of claims 50 to 53, wherein the organic solvent is isopropanol or acetone.

55. The method for treating a polyester as  
15 claimed in any one of claims 50 to 54, wherein polyethylene terephthalate, which is obtained by the use of a titanium compound catalyst and in which the reaction has been completed, is treated.

56. A polyester (P-1) obtained by polycondensing  
20 an aromatic dicarboxylic acid or an ester-forming derivative thereof and an aliphatic diol or an ester-forming derivative thereof in the presence of the catalyst for polyester production as claimed in claim 6 or 10, wherein the titanium content is in the range

of 1 to 100 ppm, the magnesium content is in the range of 1 to 200 ppm, and the weight ratio (Mg/Ti) of magnesium to titanium is not less than 0.01.

5        57. The polyester (P-1) as claimed in claim 56, which is polyethylene terephthalate

58. A polyester (p-2) having the following properties:

10        a titanium atom is contained in an amount of 0.1 to 200 ppm,

15        a metal atom M selected from beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc and antimony is contained in an amount of 0.1 to 500 ppm,

the molar ratio (titanium atom/metal atom M) of the titanium atom to the metal atom M is in the range of 1/50 to 50/1, and

20        a tint adjusting agent is contained in an amount of 0.01 to 100 ppm.

59. A polyester (p-3) having the following properties:

the intrinsic viscosity is not less than 0.50 dl/g,

a titanium atom is contained in an amount of 0.1 to 200 ppm,

a metal atom M selected from beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc and antimony is contained in an amount of 0.1 to 500 ppm,

the molar ratio (titanium atom/metal atom M) of the titanium atom to the metal atom M is in the range of 0.05 to 50, and

10 the content of acetaldehyde is not more than 4 ppm, and when this acetaldehyde content is taken as  $W_0$  ppm and a content of acetaldehyde in a stepped square plate molded product obtained by heating said polyester to a temperature of 275°C to melt it and  
15 molding the molten polyester is taken as  $W_1$  ppm, the value of  $W_1 - W_0$  is not more than 10 ppm.

60. The polyester (P-3) as claimed in claim 59, wherein the titanium atom is derived from a  
20 polycondensation catalyst obtained by hydrolysis of a titanium halide.

61. The polyester (P-3) as claimed in claim 59 or 60, which is polyethylene terephthalate.



62. A polyester (P-4) having the following properties:

the intrinsic viscosity is not less than 0.50 dl/g,

5 a titanium atom is contained in an amount of 0.1 to 200 ppm,

a metal atom M selected from beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt, zinc and antimony is contained in  
10 an amount of 0.1 to 500 ppm,

the molar ratio (titanium atom/metal atom M) of the titanium atom to the metal atom M is in the range of 0.05 to 50, and

the content of a cyclic trimer is not more than  
15 0.5 % by weight, and when this cyclic trimer content is taken as x % by weight and a content of a cyclic trimer in a stepped square plate molded product obtained by heating said polyester to a temperature of 290°C to melt it and molding the molten polyester is  
20 taken as y % by weight, x and y satisfy the following relation

$$y \leq -0.2x + 0.2.$$

63. The polyester (P-4) as claimed in claim 62, wherein the titanium atom is derived from a polycondensation catalyst obtained by hydrolysis of a titanium halide.

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64. The polyester (P-4) as claimed in claim 62 or 63, which is polyethylene terephthalate.

65. A polyester (P-5) having the following  
10 properties:

when the ratio (L/T) of a flow length (L) to a flow thickness (T) in the injection molding of said polyester at 290°C is taken as Y and the intrinsic viscosity of a molded product obtained by the  
15 injection molding is taken as X (dl/g), X and Y satisfy the following relation

$$Y \geq 647-500X.$$

66. The polyester (P-5) as claimed in claim 65,  
20 which is obtained by polycondensing an aromatic dicarboxylic acid or an ester-forming derivative thereof and an aliphatic diol or an ester-forming derivative thereof in the presence of a

polycondensation catalyst comprising a hydrolyzate (I-m) obtained by hydrolyzing a titanium halide.

67. The polyester (P-5) as claimed in claim 65,  
5 which is obtained by polycondensing an aromatic dicarboxylic acid or an ester-forming derivative thereof and an aliphatic diol or an ester-forming derivative thereof in the presence of a polycondensation catalyst comprising a hydrolyzate (I-  
10 n) obtained by hydrolyzing a mixture of a titanium halide and a compound of at least one element selected from elements other than titanium or a precursor of the compound.

15 68. The polyester (P-5) as claimed in claim 67, wherein the compound of at least one element selected from elements other than titanium or the precursor of the compound is a compound of at least one element selected from the group consisting of beryllium,  
20 magnesium, calcium, strontium, barium, scandium, yttrium, lanthanum, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, manganese, iron, ruthenium, cobalt, rhodium, nickel, palladium, copper, zinc, boron, aluminum, gallium,

silicon, germanium, tin, antimony and phosphorus or a precursor of the compound.

69. The polyester (P-5) as claimed in claim 65,  
5 which is obtained by polycondensing an aromatic dicarboxylic acid or an ester-forming derivative thereof and an aliphatic diol or an ester-forming derivative thereof in the presence of:

(I) the polycondensation catalyst of any one of  
10 claims 66 to 68, and

(II) a co-catalyst component comprising a compound of at least one element selected from the group consisting of beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, manganese, cobalt,  
15 zinc, germanium, antimony and phosphorus.

70. The polyester (P-5) as claimed in claim 69, wherein the co-catalyst compound (II) is a magnesium compound.

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71. The polyester (P-5) as claimed in claim 70, wherein the titanium atom content is in the range of 1 to 100 ppm, the magnesium atom content is in the range of 1 to 200 ppm, and the weight ratio (Mg/Ti) of the

magnesium atom to the titanium atom is not less than 0.01.

72. The polyester (P-5) as claimed in any one of  
5 claims 65 to 71, which is polyethylene terephthalate.

73. A molded product obtained from the polyester (P-1) as claimed in any one of claims 56 to 57.

10 74. The molded product as claimed in claim 73, which is a blow molded article.

75. The molded product as claimed in claim 73, which is a film or a sheet.

15 76. The molded product as claimed in claim 73, which is a fiber.

77. A blow molded article obtained from the  
20 polyester (P-4) as claimed in any one of claims 62 to 64 and having a cyclic trimer content of not more than 0.6 % by weight.

78. A preform for a blow molded article, which is obtained from the polyester (P-5) as claimed in any one of claims 65 to 72.

5        79. A blow molded article obtained from the polyester (P-5) as claimed in any one of claims 65 to 72.

100-442, 100-443, 100-444, 100-445, 100-446, 100-447, 100-448, 100-449, 100-450, 100-451, 100-452, 100-453, 100-454, 100-455, 100-456, 100-457, 100-458, 100-459, 100-460, 100-461, 100-462, 100-463, 100-464, 100-465, 100-466, 100-467, 100-468, 100-469, 100-470, 100-471, 100-472, 100-473, 100-474, 100-475, 100-476, 100-477, 100-478, 100-479, 100-480, 100-481, 100-482, 100-483, 100-484, 100-485, 100-486, 100-487, 100-488, 100-489, 100-490, 100-491, 100-492, 100-493, 100-494, 100-495, 100-496, 100-497, 100-498, 100-499, 100-500, 100-501, 100-502, 100-503, 100-504, 100-505, 100-506, 100-507, 100-508, 100-509, 100-510, 100-511, 100-512, 100-513, 100-514, 100-515, 100-516, 100-517, 100-518, 100-519, 100-520, 100-521, 100-522, 100-523, 100-524, 100-525, 100-526, 100-527, 100-528, 100-529, 100-530, 100-531, 100-532, 100-533, 100-534, 100-535, 100-536, 100-537, 100-538, 100-539, 100-540, 100-541, 100-542, 100-543, 100-544, 100-545, 100-546, 100-547, 100-548, 100-549, 100-550, 100-551, 100-552, 100-553, 100-554, 100-555, 100-556, 100-557, 100-558, 100-559, 100-560, 100-561, 100-562, 100-563, 100-564, 100-565, 100-566, 100-567, 100-568, 100-569, 100-570, 100-571, 100-572, 100-573, 100-574, 100-575, 100-576, 100-577, 100-578, 100-579, 100-580, 100-581, 100-582, 100-583, 100-584, 100-585, 100-586, 100-587, 100-588, 100-589, 100-590, 100-591, 100-592, 100-593, 100-594, 100-595, 100-596, 100-597, 100-598, 100-599, 100-600, 100-601, 100-602, 100-603, 100-604, 100-605, 100-606, 100-607, 100-608, 100-609, 100-610, 100-611, 100-612, 100-613, 100-614, 100-615, 100-616, 100-617, 100-618, 100-619, 100-620, 100-621, 100-622, 100-623, 100-624, 100-625, 100-626, 100-627, 100-628, 100-629, 100-630, 100-631, 100-632, 100-633, 100-634, 100-635, 100-636, 100-637, 100-638, 100-639, 100-640, 100-641, 100-642, 100-643, 100-644, 100-645, 100-646, 100-647, 100-648, 100-649, 100-650, 100-651, 100-652, 100-653, 100-654, 100-655, 100-656, 100-657, 100-658, 100-659, 100-660, 100-661, 100-662, 100-663, 100-664, 100-665, 100-666, 100-667, 100-668, 100-669, 100-670, 100-671, 100-672, 100-673, 100-674, 100-675, 100-676, 100-677, 100-678, 100-679, 100-680, 100-681, 100-682, 100-683, 100-684, 100-685, 100-686, 100-687, 100-688, 100-689, 100-690, 100-691, 100-692, 100-693, 100-694, 100-695, 100-696, 100-697, 100-698, 100-699, 100-700, 100-701, 100-702, 100-703, 100-704, 100-705, 100-706, 100-707, 100-708, 100-709, 100-710, 100-711, 100-712, 100-713, 100-714, 100-715, 100-716, 100-717, 100-718, 100-719, 100-720, 100-721, 100-722, 100-723, 100-724, 100-725, 100-726, 100-727, 100-728, 100-729, 100-730, 100-731, 100-732, 100-733, 100-734, 100-735, 100-736, 100-737, 100-738, 100-739, 100-740, 100-741, 100-742, 100-743, 100-744, 100-745, 100-746, 100-747, 100-748, 100-749, 100-750, 100-751, 100-752, 100-753, 100-754, 100-755, 100-756, 100-757, 100-758, 100-759, 100-760, 100-761, 100-762, 100-763, 100-764, 100-765, 100-766, 100-767, 100-768, 100-769, 100-770, 100-771, 100-772, 100-773, 100-774, 100-775, 100-776, 100-777, 100-778, 100-779, 100-780, 100-781, 100-782, 100-783, 100-784, 100-785, 100-786, 100-787, 100-788, 100-789, 100-790, 100-791, 100-792, 100-793, 100-794, 100-795, 100-796, 100-797, 100-798, 100-799, 100-800, 100-801, 100-802, 100-803, 100-804, 100-805, 100-806, 100-807, 100-808, 100-809, 100-810, 100-811, 100-812, 100-813, 100-814, 100-815, 100-816, 100-817, 100-818, 100-819, 100-820, 100-821, 100-822, 100-823, 100-824, 100-825, 100-826, 100-827, 100-828, 100-829, 100-830, 100-831, 100-832, 100-833, 100-834, 100-835, 100-836, 100-837, 100-838, 100-839, 100-840, 100-841, 100-842, 100-843, 100-844, 100-845, 100-846, 100-847, 100-848, 100-849, 100-850, 100-851, 100-852, 100-853, 100-854, 100-855, 100-856, 100-857, 100-858, 100-859, 100-860, 100-861, 100-862, 100-863, 100-864, 100-865, 100-866, 100-867, 100-868, 100-869, 100-870, 100-871, 100-872, 100-873, 100-874, 100-875, 100-876, 100-877, 100-878, 100-879, 100-880, 100-881, 100-882, 100-883, 100-884, 100-885, 100-886, 100-887, 100-888, 100-889, 100-890, 100-891, 100-892, 100-893, 100-894, 100-895, 100-896, 100-897, 100-898, 100-899, 100-900, 100-901, 100-902, 100-903, 100-904, 100-905, 100-906, 100-907, 100-908, 100-909, 100-910, 100-911, 100-912, 100-913, 100-914, 100-915, 100-916, 100-917, 100-918, 100-919, 100-920, 100-921, 100-922, 100-923, 100-924, 100-925, 100-926, 100-927, 100-928, 100-929, 100-930, 100-931, 100-932, 100-933, 100-934, 100-935, 100-936, 100-937, 100-938, 100-939, 100-940, 100-941, 100-942, 100-943, 100-944, 100-945, 100-946, 100-947, 100-948, 100-949, 100-950, 100-951, 100-952, 100-953, 100-954, 100-955, 100-956, 100-957, 100-958, 100-959, 100-960, 100-961, 100-962, 100-963, 100-964, 100-965, 100-966, 100-967, 100-968, 100-969, 100-970, 100-971, 100-972, 100-973, 100-974, 100-975, 100-976, 100-977, 100-978, 100-979, 100-980, 100-981, 100-982, 100-983, 100-984, 100-985, 100-986, 100-987, 100-988, 100-989, 100-990, 100-991, 100-992, 100-993, 100-994, 100-995, 100-996, 100-997, 100-998, 100-999, 100-1000